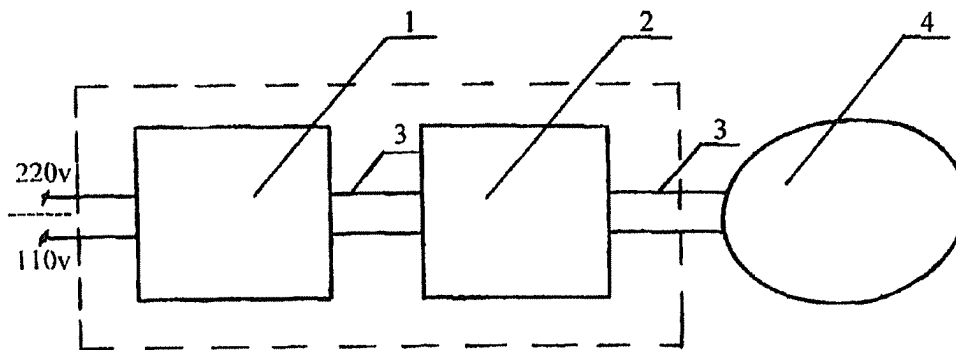




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(54) Title: METHOD AND DEVICE FOR CLEANING OF TEXTILE MATERIALS IN A WATER ENVIRONMENT



(57) Abstract

The present invention relates to a method and device for cleaning of textile materials, more especially to a washing machine, which could be used in a domestic environment for cleaning of soiled textile materials, namely clothes of natural and synthetic textile. The method for washing includes continuous supplying of vibrations of an audible frequency of 6,5 to 8 kHz and vibrations of supersonic frequency of 80 kHz for the duration of 30 to 50 minutes into a washing water environment. The device for washing consists of an electric power source (1) and active element (4) with piezo-ceramic element (7), as the element (7) being embedded in elastic material (8). Between electric source and active element (4) is installed a generator (2) of supersonic vibrations.

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METHOD AND DEVICE FOR CLEANING OF TEXTILE MATERIALS IN A WATER ENVIRONMENT

FIELD OF THE INVENTION

This invention relates to a method and a device for cleaning the textile materials, more especially to a washing machine, which could be used in a domestic environment for cleaning of soiled textile materials, namely clothes of natural and synthetic textile materials, as well as for their disinfecting.

BACKGROUND OF THE INVENTION.

Various methods and devices for cleaning of textile materials in a domestic environment are known, especially for clothes. Most often, the decomposition of the contaminants of the clothes is carried out by means of generated within the sound range signals, which are transformed into mechanical energy upon their input into a piezoelectric element.

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Author's Certificate SU № 1 730 288 describes a method for washing underwear in a water environment, including steps of prewashing and main washing, rinsing by warm and cold water, where during the entire washing cycle hydro-acoustic vibrations are delivered into the washing environment at a frequency of a 1 to 3 kHz and a vibration intensity of 0,1 to 0,5W/cm. The washing and rinsing of the underwear is carried out in an impulse mode with a frequency of the impulses at about from 1 to 2 kHz.

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5 The disadvantages of the known method are the limited utilization for washing underwear only, as well as its insufficient efficiency in washing the same. There are also possibilities for damaging the material or for sharply reducing the efficiency of the washing process in case of non-compliance with the specified ranges of
10 the acoustic vibrations and the impulse frequencies.

Another device of vibration type for washing textile materials is revealed in patent No 2047676 – RU. The known device consists of a body, with an vibration element installed within the body. The space between the body and the vibration element is filled with a sealing
15 elastic compound. As a vibration element a piezo - ceramic plate is used, the longitudinal axis of which being parallel to the wall of the body. The vibration element is connected to the power source, preferably the electric power supply network, the input frequency of the vibration element coinciding with the frequency of the
20 electric power supply network, i.e. 50-60 Hz.

This known device is not efficiently enough, since it cannot provide quick washing of sufficient quality due to its limited range of vibrations, which depend on the frequency of the industrial electric power supply network.

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SUMMARY OF THE INVENTION.

The aim of the invention is to provide a method and a device for cleaning textile materials in a water environment, which enable an efficient cleaning of soiled textile materials of natural and
30 of synthetic nature at a guaranteed protection of the quality, the colour and the structure of the washed material.

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5 The above stated objects of the invention are achieved by means of a method for washing textile materials which includes continuous supplying of vibrations of an audible frequency of 6,5 to 8 kHz and vibrations of supersonic frequency of 80 kHz for the duration of 30 to 50 minutes into the washing water environment.

10 The aim of the invention is achieved also by means of a device for washing textile materials, consisting of an electric power source, to which an active element with a piezo-ceramic element is connected, the element being embedded in elastic material.

15 According to the invention between the electric source and the active element a generator of supersonic vibrations is installed, the generator having an adjustable resistor connected between the electrodes of a transistor. The active element is oval-shaped, and a holder is installed asymmetrically along the short axis of the active element. A piezo-ceramic element is fixed in the interior of the holder.

20 In accordance with one of the preferred embodiments of the device the deviation of mounting of the holder of the piezo-ceramic element is within the range of 1 to 5 mm.

25 In accordance with another embodiment of the device the active element is filled with an elastic compound comprising liquid silicon rubber of 1,2-1,3 density and $40-60 \pm 5\%$ Shore hardness.

 The proposed method and a device for cleaning textile materials provide an efficient cleaning of soiled clothes in a water environment in combination with washing detergents.

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5 The cleaning washing effect is due to the well-chosen frequency ranges, within which the generator and the piezo element operate. At the same time the emitted by the active element vibrations considerably improve the efficiency of the washing process due to the new oval shape of the active element, as well as due to the
10 different position of the piezo-element, i.e. asymmetrically along the short axis of the oval within a rigidly fixed holder.

 The device provides for efficient cleaning of textile materials of natural and synthetic nature with a guaranteed protection of the material structure, the colouring and the quality of the washed clothes.

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BRIEF DESCRIPTION OF THE DRAWINGS

 This invention is illustrated, but not limited by the following description with reference to the accompanying drawings in which:

- Fig.1 presents a block diagram of the invented device;
- 20 - Fig.2 is an electric diagram of the generator block;
- Fig.3 is a plain view of the active element;
- Fig.4 is longitudinal section of the active element.

DETAILED DESCRIPTION OF THE INVENTION

25 With reference to the accompanying drawings one embodiment of The method and the device for cleaning textile materials, according to the invention will now be described. The elements and materials specified therein are not to be considered as restricting the use of other known materials of similar characteristics and parameters.

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5 The method for cleaning textile materials consists of following sequence of steps: a known type of washing detergent is added to a water, warmed up to a temperature of 45°C to 60°C. The textile material to be washed, e.g. made of natural materials (shirts, blouses, underwear) is then placed into the container with
10 the active element placed underneath the same in the washing water environment. The power supply is then connected to the power source (the electric power supply network) of 220V and the generator block starts to emit vibrations within the range of the 6,5 to 8 kHz.

Due to the additionally foreseen capacitor C and the adjustable
15 resistor R the generator emits vibrations within the audible frequency range from about 6,5 to 8,0 kHz, e. g. 7,2 kHz., as well as higher harmonic vibrations of frequency at 80 kHz, thus forming two fields - a field within the audible sound range and a field in the supersonic range. The interpolation of both fields forms a combined
20 field, which is applied to the washing environment, respectively to the clothes to be washed by means of the active elastic element.

The device for cleaning textile materials consists of a power supply block 1, connected to the audible vibration generator 2, the output of which is connected via power cable 3 to the oval-shaped
25 active element 4. The round-shaped holder 6 is fixed inside the active element 4 by means of fixing element 5, the holder 6 being fixed asymmetrically along the short axis of the active element 4 at a distance of from 1 to 5mm, e.g. 5 mm.

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5 The piezo-ceramic element 7 is installed inside the holder 6, and the complete volume of the active element 4 is filled with an elastic material 8, e.g. liquid silicon rubber of the "Silast D2" type of 1,26 density and $48 \pm 5\%$ Shore hardness.

As an elastic filler can be used various known types of rubber
10 and elastic materials of elasticity factor at about from 1,0 to 1,5.

INDUSTRIAL APPLICABILITY

The device for cleaning of textile materials is foreseen to be used in the following manner: a washing solution is prepared by
15 mixing water warmed up to 45° to 60°C with a washing (powder, liquid, etc.) detergent, the quantity of this solution being prepared in accordance with the instructions. The active element 4 is then placed on the bottom of the container, over which the textile materials to be cleaned are freely placed. Upon connection of the
20 power supply block 1 to the power source, the generator 2 starts to emit signals within a range of frequency at about from 6,5 to 8,0 kHz. e.g. of the frequency, at which the generator 2 has been pre-set. At the same time the secondary winding (L1) of the generator 2 emits signals at a frequency of 80 kHz, thus two main frequencies are
25 generated at the output of the generator 2. Both frequencies interpolate and the resulting signal is fed to the piezo-ceramic element 7, which transforms the electric signals into mechanical vibrations. The mechanical vibrations are transmitted to the water through the elastic coating, and their frequency aids the efficient
30 decomposition of the contamination of the textile materials.

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CLAIMS

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1. A method for washing textile materials, including treatment of the soiled textile materials by supersonic vibrations at supersonic frequency, **characterised in that** the textile materials are simultaneously subjected to vibrations within the range of audible frequency at 6,5 to 8 kHz and to vibrations of supersonic frequency at 80 kHz for the duration of 30 to 50 minutes.
2. A device for washing textile materials according to the method of claim 1, comprising a power supply block and a piezo-ceramic element, fixed within the active element and enclosed in elastic material, **characterised in that** between the power supply block /1/ and the active element /4/ a generator of audible and supersonic frequency vibrations is provided, the active element /4/ being oval-shaped, in which a holder for the piezo-ceramic element /7/ is installed asymmetrically along the short axis of the active element /4/.
3. A device according to the claim 2, **characterised in that** the holder /6/ for the piezo-ceramic element /7/ is shifted along the short axis of the oval shape at a distance of 1 to 5 mm.
4. A device according to the claim 2, **characterised in that** the elastic material /8/, enclosing the piezo-ceramic element /7/, comprises liquid silicon rubber at a density of 1,2 to 1,3 and at a hardness of $40 - 60 \pm 5$ % Shore.

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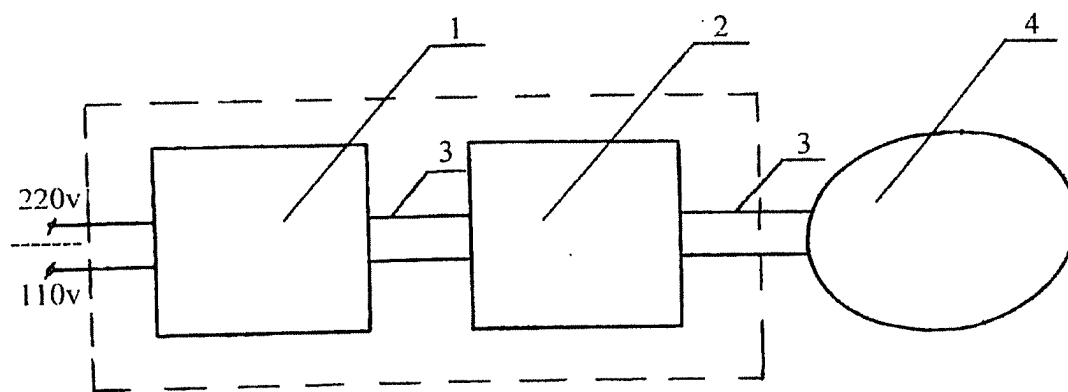


FIG. 1

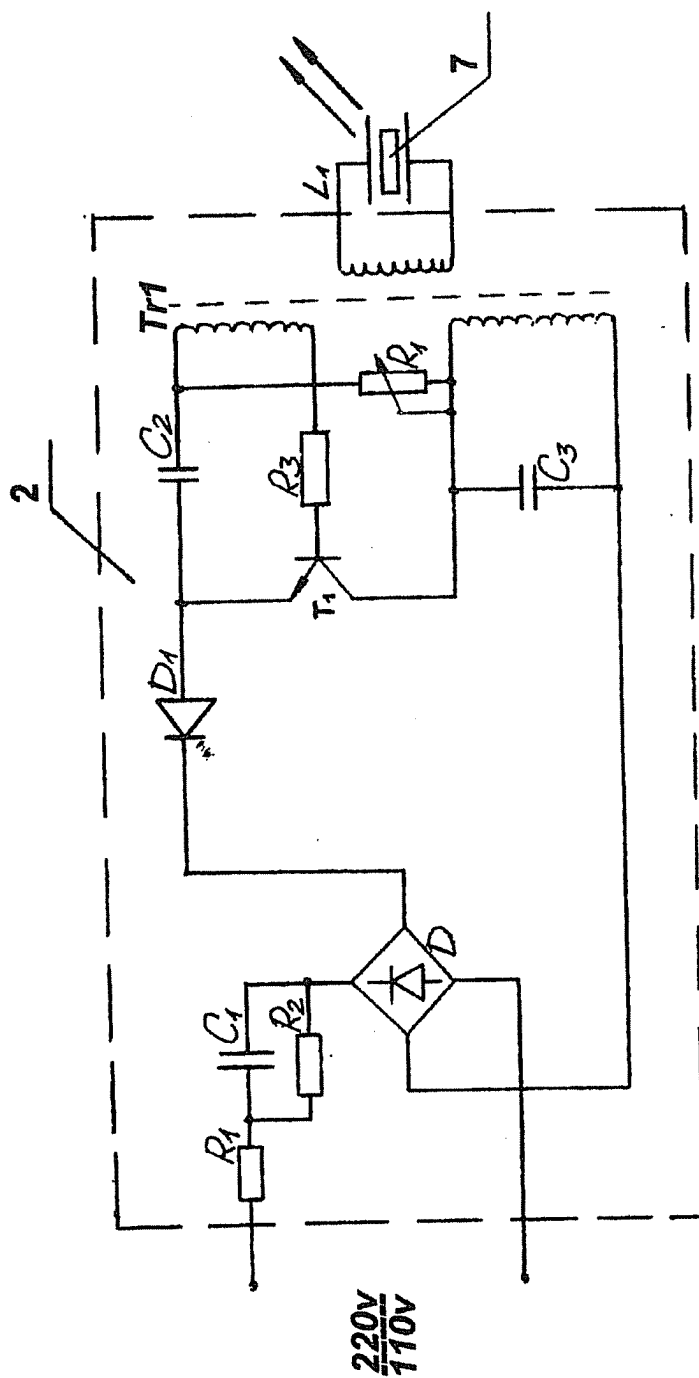


Fig.2

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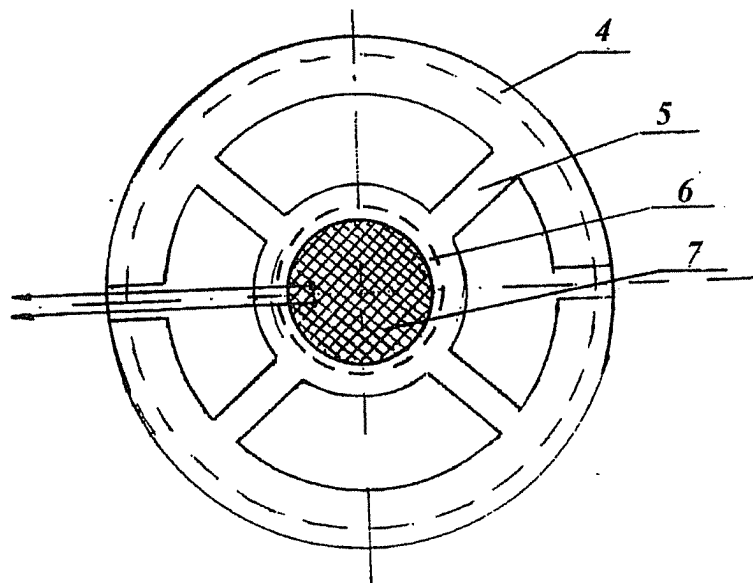


FIG. 3

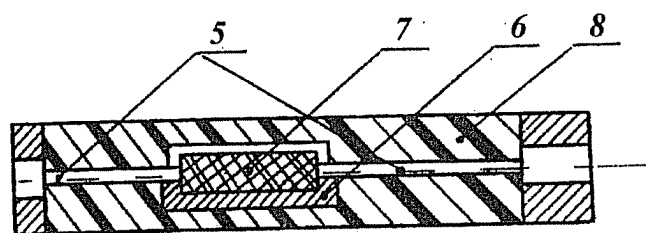


FIG. 4

INTERNATIONAL SEARCH REPORT

International Application No

PCT/BG 98/00018

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 D06F19/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 D06F

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Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|---|-----------------------|
| X A | WO 96 37314 A (P. BUX) 28 November 1996 see page 6, line 1 - page 7, line 21; claims; figures | 1 2 |
| X A | DD 244 584 A (VEB KOMBINAT DIENSTLEISTUNGEN BERLIN) 8 April 1987 see claims; figures | 1 2 |
| A | EP 0 392 586 A (WHITE INTERNATIONAL N.V.) 17 October 1990 see claims 1-3,6; figures | 1,2 |
| A | EP 0 288 378 A (J. BLASSUTTI) 26 October 1988 see claim 1 | 2 |
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| A | <p>WO 90 06817 A (GRÜNDBECK WASSERAUFBEREITUNG GMBH) 28 June 1990 see claims 1-9; figures -----</p> | 2 |

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|---|---------------------|--|--|
| WO 9637314 A | 28-11-1996 | FR 2734502 A AU 6008096 A | 29-11-1996 11-12-1996 |
| DD 244584 A | 08-04-1987 | NONE | |
| EP 392586 A | 17-10-1990 | NL 8900929 A | 01-11-1990 |
| EP 288378 A | 26-10-1988 | FR 2614325 A | 28-10-1988 |
| WO 9006817 A | 28-06-1990 | DE 3843110 C CS 8907297 A EP 0401364 A | 22-02-1990 15-09-1991 12-12-1990 |